Hot Jupiters and Hot Spots: The Detection of Planet-Star Magnetic Interactions

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Our observations of excitation of stellar chromospheres by short-period (hot) jupiter-mass companions are the first evidence for extrasolar planetary magnetic fields. Because of their small separation (< 0.1 AU), hot jupiters almost certainly lie within the Alfvén radius of their host stars, thereby allowing direct magnetic interaction with the stellar surface. We monitored the chromospheric activity with the Ca II H & K lines (396.8 and 393.3 nm) of 13 solar-type stars (including the Sun); 8 of them over three years at the Canada-France-Hawaii Telescope and 5 in a single run at the Very Large Telescope. For the 10 stars with planets, chromospheric activity correlates directly with the planet's projected mass ($M_p \sin i$). Four stars display short-term (days) cyclical activity and for two, HD 179949 and υ And, the periodic activity is synchronized to the planetary period. For both stars this synchronism is seen clearly in two out of three epochs. The effect is only marginal in the third epoch when the general level of chromospheric activity had changed in both stars. For the other two stars, HD 73256 and κ^1 Ceti, activity is associated with an active region rotating with the star, although flaring in excess of the rotational modulation may be associated with a hot jupiter. Short-term chromospheric activity depends weakly on the mean K-line emission intensities for our complete sample.